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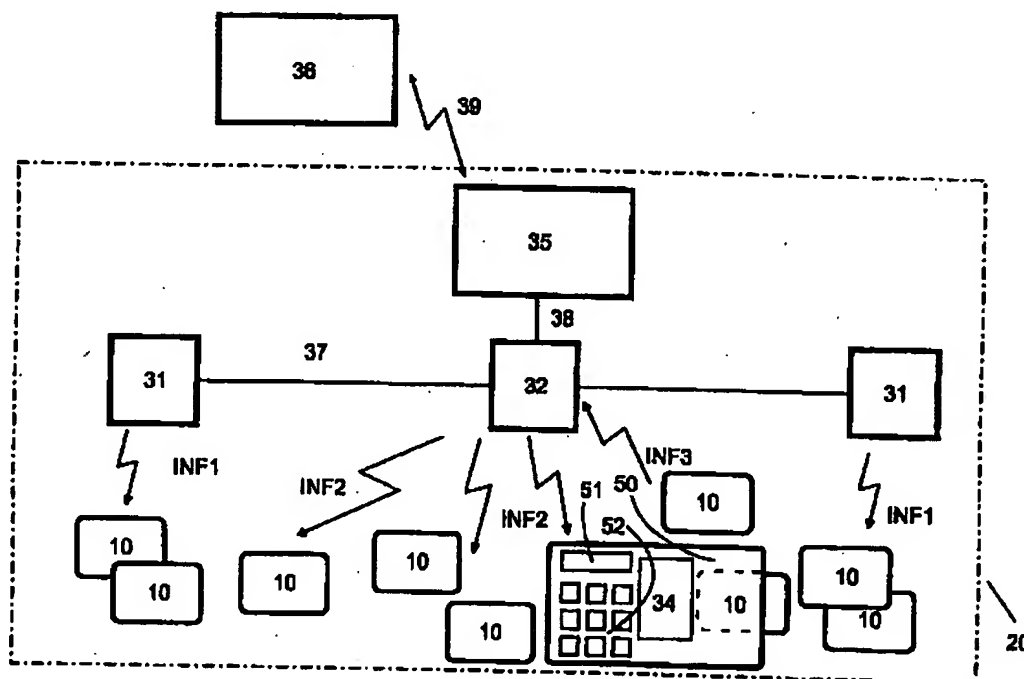
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(57) Abrégé/Abstract:

In an entrance zone (21), or a prompting zone (21'), a second transmitting-receiving module (12) located on the ticket (10) is activated (INF1). A communication (INF2, INF3) can thus be established between the ticket (10) and a second transmitting-receiving unit (32) which is assigned to a detection zone (22). During this communication, the presence of the ticket (10) is determined and registered in a defined time-slot pattern. This guarantees a reliable and fraud-proof detection of tickets. The method and system for registering tickets (10) is used in public transport, at exhibitions and in secured areas.



Abstract

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METHOD AND SYSTEM FOR REGISTERING TICKETS

The present invention relates to a method and a system according to the precharacterizing clause of patent claims 1 and 18 and 25 and 34, respectively.

The issuing of tickets and collection of fares by means of automatic ticket machines or manned points of sale is expensive for the transport company and sometimes very inconvenient for the passenger. If a passenger arrives at the place of boarding immediately before the departure of a means of transport, he no longer has time to get a ticket. He gets on board and risks being accused of being a fare dodger if there is a ticket inspection. This involves considerable costs and unpleasantness.

[3] discloses a contactless identification system with electronic access cards, with which a person can be granted access to a closed area, for example a building. The system described in [4] additionally makes it possible to transmit data to the electronic access card, in order for example to change the access profile or disable the access card. These systems are not very suitable for the registration of electronic tickets, since such a card only allows one person to be registered at a time.

The arrangement specified in [2] allows a number of electronic tickets to be registered at a place of admission (for example to the subway) or at a place of boarding (for example the door area of a railway carriage).

The publication GB 2 246 896 A discloses a ticket system for a means of transport in which location messages sent out by a broadcast method during a journey are stored on the tickets. When a passenger with such a ticket leaves the vehicle concerned, the location messages stored on the ticket and further data are inquired in order to check the validity of the ticket concerned for the journey undertaken.

For such a method - also referred to as "walk in/walk out" - the registration of electronic tickets must additionally satisfy the following conditions:

- a) The registration must be thorough, for instance the tickets in a coat pocket for a father and those for the children traveling with him must be registered.
- b) No unwanted registration may take place, for example

if a person with such an electronic ticket helps another person to get on board, this other person must not be registered as a passenger from whom payment is required.

c) The registration must be as immune to fraud as possible, for instance it should be possible to detect covering of the electronic ticket by means of a metallic foil.

Methods and systems of the type specified in [2] only inadequately satisfy requirements b) and c) given above as examples, since the direction in which a registration zone is passed cannot be detected.

The present invention is therefore based on the object of specifying a method and a system for registering electronic tickets with which the non-registration of genuine passengers or service users and the unwanted registration of persons with an electronic ticket are avoided and attempted fraud by temporarily shielding the electronic ticket can be reliably detected.

This object is achieved by the measures specified in patent claims 1, 15, 25 and 34. Advantageous refinements of the invention are specified in further claims.

The method according to the invention has the following advantages:

- i) The (transport) service actually used can be registered and, if need be, a charge made. In this case, the actual traffic data (frequencies, occupation of the carriages, type of tickets) are available to the transport company virtually in real time.
- ii) Unwanted registration is avoided by the validation of the registration taking place during the journey or while the

service is being used. The mere boarding of a vehicle or entering of an area does not bring about validated registration (claim 5).

iii) Persons with a ticket according to the invention who make use of a transport service or other service are always registered. Boarding very quickly, loitering in the entrance area or putting the ticket in an unusual place (for example in one's shoes) cannot prevent registration.

iv) Attempted fraud by shielding the ticket at the beginning and during use of a service can be detected. Attempted fraud at the end of use of a service is ineffective because validation of the registration takes place intermittently during the journey. Resistance to fraud can be enhanced considerably by random ticket inspection (claim 9).

v) The intermittent operation of a second transmitting/receiving module on the ticket according to the invention has the effect of minimizing the power consumption and, as a result, of achieving high autonomy (claims 6, 7 and 8).

vi) The bidirectional communication has the effect that the registered journeys are contained both on the ticket and in a data bank assigned to the registration zone and also in a stationary computer system for evaluation and/or billing (claim 2).

vii) In a special refinement of the invention, the tickets may be provided with a display module. This allows general or specific information for the attention of the person concerned to be displayed (claim 17).

iix) The use of an electronic ticket as a locational marker allows a low-cost transmission of locational information to a vehicle traveling past (patent claim 24).

ix) The chosen method of transmission allows a reading/writing device to be used for reliable information transmission to an

electronic ticket without a complex mechanical insertion device being required (claims 33, 37).

The invention is not restricted to the transport sector but can also be used for electronic admission or entry tickets, for example to an exhibition. It is also possible to design the invention as an identity card. The term "ticket" used in this document therefore also always covers the terms "admission ticket", "entry ticket" or "identity card" and similar tickets and passes.

The invention is explained in more detail below by way of example with reference to a drawing, in which:

Fig. 1 shows a block diagram of an electronic ticket for the method according to the invention;

Fig. 2 shows the outline of a vehicle with the arrangement of a first transmitting unit and a second transmitting/receiving unit and the associated zones;

Fig. 3 shows the individual method steps for the registration of an electronic ticket;

Fig. 4 shows a functional and logical breakdown of the various areas of the memory module 16;

Fig. 5 shows a system overview and information flows in the registration of electronic tickets;

Fig. 6 shows an arrangement of an electronic ticket as a marker for the transmission of locational information to a vehicle traveling past;

Fig. 7 shows a representation of the transmission of journey section numbers in an embodiment of the invention,

Fig. 8 shows a block diagram of a reading/writing device for the assignment of an entitlement to a ticket;

Fig. 9 shows a block diagram of an electronic ticket for a further refinement of the invention;

Fig. 10 shows the outline of a motor bus with the arrangement of a first transmitting unit and a receiving unit and the associated zones in a further refinement of the invention;

Fig. 11 shows the individual method steps for the registration of an electronic ticket in a further refinement of the invention.

Represented in Fig. 2 is the outline of a railroad carriage 20 with a boarding area 25 at each end of the carriage and also a passing-through area 26. The passing-through area 26 makes it possible to pass through to a further carriage of a train. These two areas 25, 26 allow access via a platform 24 to the passenger compartment 23. Doors have not been depicted for the sake of clarity. The platform 24 and the passenger compartment 23 may be open or provided with a wall and an associated door. Assigned to each of the two platforms 24 is a first transmitting unit 31, which covers the entry zone 21 concerned with an electromagnetic field in a waking zone 21'. In applications other than in the present example with a railroad carriage, the entry zone 21 need not necessarily coincide with the platform 24. A second transmitting/receiving unit 32 is assigned to the passenger compartment 23 and likewise covers a registration zone 22 with an electromagnetic field. The zones depicted correspond approximately to the coverage with regard

to a minimal field strength of the transmitting units 31 and 32 concerned. The waking zone 21' is preferably assigned to the entry zone 21, but it is also possible to place the waking zones 21' at other locations, for example for a number of waking zones 21' to cover a registration zone 22 or for one or more waking zones to overlap only slightly with the registration zone 22.

Fig. 1 shows the block diagram of an electronic ticket 10. Such tickets 10 preferably have a credit card format. These tickets 10 can be used both as a credit card and as a debit card. With respect to the technology, such portable cards are known to a person skilled in the art for example by the term "smart card", for example in [2] or [5]. Provided in the block diagram as the central control unit is a processor module 16, connected to an assigned memory module 17 and also to a receiving module 11, a second transmitting/receiving module 12, a third transmitting/ receiving module 13 and a fourth transmitting/receiving module 14. Depending on the chosen frequencies, only one or more than one antenna may be provided; in the embodiment according to Fig. 1, two antennas 15.1 and 15.2 are provided. The power supply takes place by means of a battery 19 and a power supply module 18; the connections are not depicted for the sake of clarity. The function, the air clearances to be bridged and the sensitivity of the various transmitting/receiving modules are explained in the following table 1, in which the sensitivity ratings given are intended to be relative to one another.

Reference numeral	Function	Approximate range	Sensitivity of receiving module
11	Activation of the tickets in the entry zone.	3 m	Low
12	Bidirectional communication of a number of electronic tickets with a transmitting/receiving unit in a registration zone.	20 m	High
13	Communication of a transmitting/receiving unit in a passing zone with precisely one ticket in each case.	0.6 m	Moderate
14	Bidirectional communication with an issuing machine for the initializing/"personification" of the ticket 10 and for an insight into the journeys registered.	A few cm	Very low

Table 1

The method according to the invention is now explained with reference to Fig. 3, which shows the information flow over the air clearances between a first transmitting unit 31, a second transmitting/receiving unit 32 and an electronic ticket 10. Fig. 2 should be referred to for the sequence of movements of a person P who is carrying such a ticket 10 (for example in

his wallet) and for the spatial arrangement in a railroad carriage 20. Fig. 4 reveals the type of storage of the various information units and fields.

Method step A1

The ticket 10 is in a power-saving "sleeping state", i.e. only the first receiving module 11 is ready to receive. If a person P in a station approaches the boarding area 25 of a railroad carriage 20, this person P with the ticket 10 enters what is known as the entry zone 21. When the doors are open, an information unit is sent out by the first transmitting unit 31 periodically, for example at intervals of 0.5 s. This information unit, known as INF1, has a structure as shown in table 2:

Information unit INF1

Information fields	Meaning
CYCLE1	Time unit and time reference
COMMAND1	Commands to the ticket 10
POSITION1	Location, place of boarding
COURSE1	Course and/or carriage number
DATETIME1	Date and time of day
TYPE1	Type of means of transport

Table 2

This information specified is stored in the ticket 10 in an area 43 of the memory module 17: INF1_n. Repeated reception of this information unit then causes further, separate storage INF_{n+1}, if the field COURSE1 has changed, this occurs if the person P has boarded the carriage 20 of a train X and immediately alighted again and subsequently boards the carriage of a train Y. This operation also occurs when a person P with the ticket 10 according to the invention walks past close to an entry zone 21 of a carriage 20 of another

train. If the information specified in the field COURSE1 are retained, preferably only the fields CYCLE1 and COMMAND1 are updated. This operation is not restricted to one ticket 10, but takes place simultaneously for all the tickets 10 located in the entry zone 21.

Method step B1

With the reception of information units INF1 with the fields COMMAND1 and CYCLE1, a timing element of the processor module 16 is initialized. This timing element causes intermittent switching on of the second transmitting/receiving module 12 according to a cycle time t_{CYCL1} contained in the field CYCLE1. The time reference is also defined in this field CYCLE1. In Fig. 3, the respective switching state is denoted by St_{12} ; the individual method steps A1, C1, C2, etc. are entered equidistantly in Fig. 3; the indicated time periods t_{CYCL1} , t_{CYCL2} , etc. may be different, however: if a person P in a station enters the area of different entry zones 21, the cycle times respectively received according to the field CYCLE1 may likewise be different. The processor module 16 accordingly switches the transmitting/receiving module on and off in accordance with the various cycle times (intermittent reception readiness).

Method step C1

As long as the train has not yet departed, the ticket 10 receives an information unit INF2 from the second transmitting/receiving unit 32 at an interval defined according to the information field CYCLE1, for example $t_{CYCL1} = 10$ s. The structure of the information unit INF2 is similar to that of INF1 according to table 2. Additional fields ADDRESS2 and APPLICATION2 are provided in order to identify the transmitting/ receiving unit 32 concerned or to specify more precisely the use of the registration according to the

invention. This information unit, known as INF2, has a structure according to table 3:

Information unit INF2

Information fields	Meaning
CYCLE2	Time unit and time reference
COMMAND2	Commands to the ticket 10
POSITION2	Location
COURSE2	Course number
DATETIME2	Date and time of day
TYPE2	Type of means of transport
ADDRESS2	Address of the transmitting/ receiving unit 32
APPLICATION2	Application

Table 3

Method step C2

When the doors of the train are closed, for example immediately before departure, the first transmitting unit 31 is switched off, for which purpose a door contact may be used. The method step C1 has the effect that further information units INF2 are transmitted to the ticket 10, for example the cycle t_{CYCL2} can be reset, for example $t_{CYCL2} = 120$ s. After departure, the registration begins in that, in the field COMMAND2, there is the instruction to mark the place of boarding stored at the beginning, or the current location last received, - according to the field POSITION2. In a simplified embodiment of the invention, it is possible to dispense with this marking and for the marking to be performed by the subsequent method step C3, by transmission of the current location. The marking is only performed however for that memory entry of INF1_x if the identical information, i.e. course number, is contained in the field COURSE2. The remaining units INF1₂, INF1₃, .. stored in the area 43 are

shifted after the elapse of a defined time into the area 44, entries $INF1_{1L}$, $INF1_{2L}$, etc.; L stands for "lost". The information unit $INF2$ is received by all activated tickets 10 located in the registration zone 22. In the course of the time or journey, the respective location is indicated in the field $POSITION2$. It is possible that, together with the information specified in the fields $COMMAND2$ and $CYCLE2$, the cycle time for the further communication is changed once again, for example $t_{CYCL2} = 480$ s. This change allows an adaptation to the means of transport concerned, for example a much greater cycle time may be used in an intercity train than in a streetcar. It is possible for the method step C2 to be executed several times, if need be with different contents in the fields $CYCLE2$, $COMMAND2$ and $POSITION2$. At least those information units with the same information specified according to the field $COURSE2$ are stored in a short-term registration memory 41 of the memory module 17.

Method step C3

In the field $COMMAND 2$, a request that the ticket 10 is to transmit an information unit $INF3$ to the transmitting/receiving unit 32 located in the carriage 20 has been transmitted in accordance with method step C2, the point in time of the transmission being determined by a time t_{RAND2} , which either corresponds to a time specified by the transmitting/receiving unit 32 or is randomly chosen by the processor module 16 by means of a random generator. The information specified by $COMMAND2$ and $CYCLE2$ has the effect that collisions are largely avoided, but are not ruled out. Before the transmitting/receiving module 12 sends out an information unit $INF3$, a detection takes place as to whether the time slot concerned is not already occupied by another ticket 10 or by a transmitting/receiving unit 12 of another train located in the vicinity (parallel journey, crossing of

two trains). Any collision problems which may occur can be solved by methods known to a person skilled in the art, for example by the CSMA/CD method.

The information unit INF3 has a structure according to the information specified in table 4:

Information unit INF3

Information fields	Meaning
ADDRESS3	Received address of a transmitting/receiving unit 32
COURSE3	Course number
POSITION3	Marked location
ACTPOSITION3	Current position according to the POSITION2 last received
DATETIME3	Date and time of boarding
TYPE3	Type of ticket
TICKET_NR3	Ticket number
TICKET_OWNER3	Ticket owner
ATTRIBUTES3	Properties
STATE3	State information

Table 4

Only those units INF3 which coincide at least with respect to the information specified in the field COURSE3 are processed in the transmitting/receiving unit 32. Depending on the information specified in the field ADDRESS3, the units received may be stored either in a data bank; assigned to the carriage and/or train; of a computer system referred to here as the onboard computer 35. These units are referred to hereinafter as ticket records. This stored record records the presence of a ticket 10, specifying the respective location and respective date and time of day. The specified location information is known in a control system of the train concerned, for example through GPS receivers or through an

especially advantageous use of the ticket according to the invention as markers. This embodiment is described further below. The field ADDRESS3 contains the identity of the transmitting/ receiving unit 32 last received by means of INF2. With this information specified in ADDRESS3 and the information specified in COURSE3, it can be established whether a passenger with a ticket 10 has moved within the train from one carriage 22 to another carriage 20'. This is necessary, since the cycles may vary from carriage to carriage of the same train. Similarly, this information is required in order to identify possible incorrect registrations if overlaps occur between the registration zone 22 of different vehicles, for example two trains or two motor buses on a parallel journey. The field STATE3 contains state information and/or what is known as history information (pre-history). Consequently, any attempted fraud, for example a passenger enclosing the ticket 10 in a metal case during a journey and taking it out later, can be detected. It need not however only be attempted fraud. This also occurs if a ticket 10 is kept in a piece of baggage, the piece of baggage being placed at a location where cancellation effects may occur on account of reflections (Raleigh fading) or on account of unintentional shielding by metal objects. Immediately after sending out an information unit INF3, an acknowledgement with an information unit INF2 is given by the transmitting/receiving unit 32 concerned. The items of information required for the acknowledgement are contained in the fields COMMAND2, ADDRESS2 and APPLICATION2, in particular also the identity of the ticket 10 according to the field TICKET_NR3 in the information unit INF3.

Method step D1

In this method step, it is assumed - as explained under step C1 - that the ticket 10 can no longer be reached by the

transmitting/receiving unit 32. The ticket 10 will then not be able to receive any information units INF2 and not be able to transmit any information units INF3 to the second transmitting/receiving unit 32. This is established both by the processor module 16 and by the onboard computer 35 assigned to the carriage or train. Consequently, the ticket records stored in the data bank of the onboard computer 35 are provided with a flag and can be transmitted to a remote computer system 36 outside the train. On the ticket 10 itself, the stored position data are preferably likewise provided with a flag and stored in the short-term registration memory 41. This case also occurs whenever a person with the ticket 10 according to the invention leaves the carriage at the place of alighting.

Method step E1

This method step E1 is based on the following two cases:

- If a person P with the ticket 10 according to the invention leaves the carriage through the entry area 21, the information unit INF1 transmitted via the receiving module 11 is recognized by the processor module 16 as belonging to the journey concerned, but is not analyzed any further.
- Let it be assumed that the duration of the break in communication was so great that the ticket 10 has reverted to the "sleeping state". If a person P with a "sleeping" ticket 10 leaves the railroad carriage 20, the ticket 10 receives a further information unit INF1. According to the information specified in the memory areas 43 or 44, i.e. on the basis of a comparison with respect to the fields POSITION1, COURSE1, DATETIME1, it can be established by the processor module 16 that the registration in progress has failed. In this case, the processor module 16 instigates the immediate transmission of an information unit INF3.

Method step E2

This method step is executed in accordance with the following three preconditions:

- According to method step E1, the ticket 10 has been "woken". In this case, the processor module 16 instigates the immediate transmission of an information unit INF3 with the fields POSITION3 and ACTPOSITION3 to the transmitting/receiving unit 32. This ensures registration even in such a case. The transmission of information in this case can also be taken from Fig. 7 for the ticket with the number 102.
- The reception of an information unit INF1 has the effect according to the method step A1 and B1 that the ticket 10 is "woken", i.e. the transmitting/receiving module is intermittently switched to reception readiness for a fixed time. If in this time the ticket 10 does not receive any information units INF2 from the transmitting/receiving unit 32 corresponding to the one entry zone 21 (same carriage or same train), the processor module 16 instigates transmission of an information unit INF3 before "going back to sleep". If, after repeated attempts there is no acknowledgement with an information unit INF2, the corresponding entry of INF1 is shifted into the area 44 of the memory module 17. If no further current entries INF1 are contained any longer in the area 43, the ticket 10 is put into the sleeping state by the processor module 16.
- In a special further development of the invention, it is provided that, at a random time interval, for example in a range from 10 minutes to 4 hours, a ticket 10 sends out an information unit INF3 in order to receive a response from any transmitting/receiving unit 32 and thereby make registration possible.

Shown in Fig. 5 is a system and the information and data flow for the registration of tickets 10. The transmitting unit 31

and transmitting/receiving unit 32 arranged in a carriage are connected to an onboard computer 35. Such an onboard computer may be provided for each carriage 20 or for each train. The connections 37 and 38 may be wired, for example what is known as a train bus, or accomplished via a radio link. If accomplished with a radio link, preferably the same frequency and the same transmission method are used as for the connection between the transmitting/receiving unit 32 and the transmitting/receiving module 12. The onboard computer 35 contains a data bank (not represented), in which the registrations which have taken place are stored as ticket records, as they are known. Depending on the application, these ticket records are transmitted immediately after registration or after the established completion of a journey to a stationary computer system via a connection 39. GSM technology is preferably used for this connection. If the method according to the invention is used in an exclusively stationary environment, for example at an exhibition or in a museum, this link is advantageously made as a line-based link by the known methods and techniques, for example as a LAN.

The transport service to be billed is determined by a remote computer system 36 in what is known as post-processing, on the basis of the registered ticket records in their entirety.

The reception of the information unit INF1 in the entry zone 21 must be made especially dependable. To achieve the best possible penetration (through clothes, bags) and to provide the receiving module 31 with a - relatively considered - low sensitivity, and consequently to ensure a low power consumption, a frequency range in which the entry zone is in the near field of the electromagnetic field emitted by the transmitting unit 31 is preferably provided, i.e. what is known as the H field component dominates. The near field is

usually defined by $r < 0.6 \cdot \lambda$), where λ stands for the wavelength. For an extent of $(2 \cdot 6)$ m of the entry zone 21, a frequency of 38 MHz is obtained. In practice, frequencies of 27 MHz and of 13.5 MHz have proven to be particularly advantageous.

The method according to the invention with the intermittent operation of the transmitting/receiving module 12 makes possible a high level of autonomy. The following approximate calculation applies:

The ticket 10 or the transmitting/receiving module 12 is activated at intervals of $t_{\text{cycle}} = 60$ s for $t_{12} = 10$ ms:

10 ms: 60 s produces a duty cycle of $1/6000$. Taking into account a transient reaction and a corresponding load peak, the following data are taken as a basis:

Current consumption: 5 mA Voltage: 3 V

Average current consumption: $5 \text{ mA}/6000 = 0.833 \text{ } \mu\text{A}$;

The required battery capacity, rounded to the nearest Fig., is:

$1 \text{ } \mu\text{A} \cdot 26280 \text{ h} = 26 \text{ mAh}$. Batteries for smart cards with a capacity of 50 mAh and above are available on the market.

In a vehicle, it is especially important for the registration of the tickets 10 that they can be addressed by radio transmission independently of the position. The tickets 10 may also be contained in bags and these bags are either placed under a seat or on a rack near the ceiling. The field emitted by the transmitting/receiving unit 32 should have a sufficient field strength and good propagation properties, as far as possible throughout the carriage. For this purpose, a frequency which lies somewhat below the GSM 900 frequency range is preferably provided; the frequency of 868 MHz is

particularly advantageous; depending on the legal regulation, the frequency of 433 MHz may also be used. It may be provided on the ticket 10 that the intermittent activation of the second transmitting/ receiving module 12 is monitored by means of a timing element. If permanently activated, the second transmitting/receiving module 12 is switched off after a fixed time. This switching off takes place in order not to disturb the communication with the other tickets any further.

The various areas of the memory module 17 are represented in Fig. 4; the further areas required for the method according to the invention have the following four main functions:

- In the memory area 41, what are known as the short-term registrations are contained, while in the memory area 42 the long-term registrations are stored. This distinction is necessary from at least two aspects: it is also necessary for the method according to the invention that transport companies carry out a random inspection by means of personnel. For this purpose, it must also be possible for the data located on the electronic ticket 10 to be viewed by the inspection personnel by means of inspection units 50.

- The entry zones 21 and registration zones 22 of different route-bound vehicles may overlap; for example, immediately after motor buses leave a bus station, such a case may occur on a multi-lane streets:

a) Incorrect registration in the event of overlapping of the entry zone is detected by the following embodiment of the invention: provided in the memory module 17 are a number of areas in which the information contained in the information unit INF1 is stored. Once the journey has started, the bidirectional communication is commenced by means of the method steps C1, C2, ... With this information contained in IN2, the original first entry according to the information

unit INF1 received can be identified by an evaluation of the contents of the fields of COURSE, DATETIME, POSITION.

b) Incorrect registration in the event of overlapping of the registration zones is improbable in principle, one reason being the agreed communication cycles, but is not impossible. If in fact an information unit INF2 is received from a registration zone traveling for example in parallel - it is quite conceivable for there to be a number of such transmissions - it can be detected immediately by the processor module 16, on the basis of the information specified in the fields COURSE and/or ADDRESS, that this entry is to be discarded.

- In a further development of the method according to the invention, a third transmitting/receiving module 33 is provided on the ticket 10. Certain services should in any event only be accessible to the actually entitled persons. This is generally accomplished by means of special turnstiles or barriers, which only allow access to a person who has been granted admission by inserting a ticket into a reading/writing unit and subsequent devaluation invalidation or charging. The insertion of the ticket is inconvenient for the users and reduces the admission numbers considerably. For this purpose, in a passing zone to the left and right there is respectively provided a third transmitting/ receiving unit 33, which commences unidirectional or bidirectional communication with the ticket 10, depending on the type of registration and/or charging chosen. The structure of the messages exchanged is the same or similar to that indicated above in tables 1 to 3. The data storage for this is provided in the area 47. Since on a ticket 10 is intended to be used for a number of such access zones (for example ski lift in resort X and ski lift in resort Y) and the credits concerned on the ticket 10 must not be offset against one another, the area is correspondingly subdivided into partitions $D_1 \dots D_N$.

• A fourth transmitting/receiving unit 34 is provided for initialization or inspection of the ticket 10. The initialization can be performed by transferring a credit by means of an issuing machine. Such an issuing machine may be used both by the public and by a point of sale. The portable inspection unit 50 mentioned above can be used for checking the electronic tickets 10; Fig. 5 reveals how such an inspection unit 50 is embedded in the system according to the invention. A keypad 52 and a display element 51 are provided for the interaction. Likewise contained in the inspection unit 50 are a first receiving module and a second transmitting/receiving module, which can receive information units INF1 and INF2 from the first transmitting unit 31 and the second transmitting/ receiving unit 32 arranged in the carriage 30. In this way, the current position of a carriage is stored in the inspection unit 50. As a result, an up-to-the-moment inspection of the tickets 10 carried by passengers is ensured. The inspection unit also allows a passenger to verify the serviceability of the system according to the invention, for example that of the first transmitting unit 31. With this inspection unit, the registrations contained in the first journey registration memory 41 and in the second journey registration memory 42 can be displayed in plain text. This makes it possible to establish when and where the registration of a ticket was begun or was completed. This allows attempted fraud during the journey to be demonstrated. In the area 49 of the memory module 17, the data identifying a person are stored. It is also possible for the digital image of the person concerned likewise to be stored in the area 49. This is required for example when carrying out a ticket inspection. Data access to the various memory areas is determined on the one hand by the transmission path, i.e. via which receiving module 11, 12, 13 or 14 information is being transmitted, and on the other hand by the structure of information units

transmitted. The transmission path is preferably detected on the basis of a (minimal) level which has to be present at the input of the processor module 16. In addition, there must be coincidence in respect of the structure of the information unit and an authentication must be performed. At the output of the receiving module 11, an additional attenuation element may also be provided.

- The memory area 45 serves as a program memory, while temporarily required data, for example interim results on the basis of enciphering/deciphering operations to be performed for the transmission with the transmitting/receiving modules 11 to 14, are stored in the area 46.

With the issuing machine mentioned above, the public can provide a ticket 10 with further properties (ATTRIBUTES), for example the ticket can in this way be activated or deactivated. This is necessary if a person carries a number of tickets and this must not result in registration where payment is required. In a further refinement of the invention, the activation/ deactivation of the ticket 10 may also take place on a logical basis. Even a deactivated ticket 10 is registered, but it is additionally specified in an information field that the presence of this ticket does not lead to registration where payment is required. Similarly, the issuing machine can be used for example to transfer a certain number of persons to the ticket, in order that a number of persons P can undertake a journey with a single ticket 10.

On the ticket 10, a display module may be additionally provided, one reason being to allow certain data and states of the ticket 10 as the using person P himself to be viewed. By means of additional fields in the information units INF2 and INF3, it is also possible to display certain information.

In another embodiment of the invention, the first transmitting unit 31 is not switched off after the departure of the train. This is preferably performed whenever the individual registration zones of a train each have an identification of their own and, in particular, these registration zones cannot be assigned a consistent train number in accordance with the field COURSE.

The arrangement of the transmitting unit 31 and the transmitting/receiving unit 32 is not restricted to that according to Fig. 2, but instead may be adapted to the respective application. In particular, it is also envisaged to arrange the two units in one housing and to predetermine by means of a corresponding controller which of the two units 31 and 32 is permanently or intermittently activated.

As an alternative to the particulars specified in the method step D1, the data bank may be arranged in the second transmitting/receiving unit 32 itself. This allows dependable registration of the tickets present in a registration zone 22 in the case in which the connection to the onboard computer is interrupted. It is also possible that, when the second transmitting/receiving unit 32 is of a compact type of construction, the registered data are transmitted from the latter via a connection 39 to the remote computer system 36. The data bank may be coupled in a wireless or wire-bound manner to the second transmitting/receiving unit; the arrangement of the data bank is not restricted to the onboard computer 35 or the remote computer system 36.

The transmission of the current locational information to a vehicle 20, such as for example a subway train carriage, cannot be accomplished by means of a GPS receiver in tunnel sections. For this purpose, in a special embodiment of the

invention, an electronic ticket 10 is used. Fig. 6 shows in elevation a vehicle 20 which is passing a marker 64. The marker 64 is formed by a mast 61 and a recording box 62 fastened to the mast 61 at approximately the height of the vehicle roof. Accommodated in the recording box 62 are an embodiment of an electronic ticket 10 and a power supply unit (not represented). By means of an initialization stored in the program memory 45, the ticket 10 sends an information unit INF3 with, for example, a duty cycle of 3%. Arranged on the roof of the vehicle 20 is a receiving unit 63, which is connected either to an onboard computer 35 or to at least one second transmitting/receiving unit 32. The information units INF3 transmitted to the receiving unit 63 are identified in the fields STATE3 and/or ATTRIBUTES3 in such a way that the information specified in POSITION3 is evaluated by the onboard computer 35 or by the second transmitting/receiving unit 32 as locational information and is used for the communication with the tickets 10 located in the registration zone 22.

In railroad trains, it is not always possible to presume that there is a bus system for the connection of the carriages to one another. Accordingly, as already mentioned, a consistent course number cannot be used or presumed in all cases. In local transport, there is additionally the problem that a motor bus generally travels several times over the same route. Without an additional measure, this would have the consequence that a passenger who, for example, alights three stops before the terminus and, after a relatively short time at the stop, boards the same bus again in the opposite direction would be treated in the same way as a passenger with tickets not allowing registration to be correctly carried out; see in this respect the method steps E1 and E2. This would have the consequence of a charge being made for the stop X - terminus - stop X sections of the route. To eliminate this case of an

unjustified charge being made, a further embodiment of the invention is explained below with reference to Fig. 7:

In Fig. 7, I, II and III designate three stops and n , $(n+1)$ and $(n+2)$ designate the associated sections of the journey. The arrival of a bus 20 is designated by a (a: arrivée) and the departure is designated by d (d: départ). It is assumed that 936 is provided as the vehicle number in the transmitting/receiving units 31 and 32 of the bus 20. Also assumed are three tickets with the numbers 101, 102 and 103. To avoid the problems mentioned above of unjustified registration on the basis of a terminus, on the vehicle the sections of the journey are consecutively numbered with a randomly chosen initial number. This type of numbering is also commonly known by the term "virtual numbering". According to Fig. 7, these are the virtual numbers n , $(n+1)$ and $(n+2)$. If the vehicle 20 reaches a terminus, the journey section number stored on the vehicle 20 is changed by a relatively great value, for example by the value 1089 or -1089. The journey section counter is in this case designed as a modulo k counter; k has, for example, a value of $2^{16} = 65536$. This virtual numbering can also be performed with a counting increment greater than one and by means of incrementing or decrementing by a fixed value.

- Ticket 101

With this ticket, a normal journey from I to II is undertaken. On boarding, it receives via the information unit INF1 the vehicle number 936, the position information I and the journey section n . On the ticket 10, the value decremented by 1 ($n-1$) is entered. After departure d, the bidirectional communication takes place with the information units INF1 and INF2. As a result, the section n is then entered on the ticket 101. On alighting at the location II, the current position II is added to the information unit INF1 on the ticket. Furthermore, the

last stored journey section number is compared on the ticket 101 with that of the point of alighting 8; it is less by 1, i.e. the ticket has been registered correctly. The journey section number n is entered on the ticket 101.

- Ticket 102

In the case of this ticket 102, it is assumed that bidirectional communication cannot be performed for malicious or other reasons. On alighting at the location III, the ticket 102 is "woken" and thereby receives the information unit INF1. The comparison of the stored journey section number $(n-1)$ with the current number $(n+2)$, and the establishment that the vehicle number 96 is the same, shows that the ticket 102 has made the journey but was not registered. The ticket then reports its identity and the stored place of boarding I to the second transmitting/receiving unit 32 of the vehicle 20 by means of the unit INF3. On the ticket 102, the journey section number $(n+1)$ is entered. In this comparison of the journey sections, an upper limit is provided. If this limit is exceeded in the comparison, this means that a passenger with the ticket has boarded the same bus again and not for instance made a "concealed" journey.

- Ticket 103

This ticket starts a normal journey from I to III and onward. The last location in each case is stored on the ticket and on the vehicle by the bidirectional communication, by means of the information units INF2 and INF3.

The method disclosed above with the section numbering is not restricted to journey sections as such; for example, in a stationary environment this method can also be applied to time sections, for example in a resolution of 15 minutes, to establish the permanent or intermittent presence of a ticket 10 in a registration zone 22.

Shown in Fig. 8 is a block diagram of a preferred embodiment of a writing/reading device 80, which allows certain information to be transmitted onto a ticket 10 and information stored on the ticket 10 to be read. The writing/reading device 80 contains a processor module 86 and a memory module 87, which is divided into a read-only memory and a volatile memory. The communication with a ticket 10 by means of the transmission of a first information unit INF1 takes place via a modulator 81 and a downstream transmitting amplifier 83, to which a frame antenna 85.1 is connected; also connected in parallel with this is a resonance capacitor. Data stored in the ticket 10 are received by a rod antenna 85.2 and fed via a receiving amplifier 84 and a demodulator 82 to a processor system 86. The writing/reading device 80 may have an encryption module 88. The writing/reading device 80 is preferably connected via a standardized interface 89, for example USB, to a customary personal computer, which for its part is connected to a network. Standardized interfaces such as USB, which also allow power to be supplied to the writing/reading device, are used with preference. With the writing/reading device 80 it is possible by a further refinement of the method according to the invention to allocate to a ticket 10 an individual entitlement or information identifying a person: an entitlement is fetched by a transport company by means of a data connection to the network, for example by electronic payment facilities, and passed on for transmission to an electronic ticket 10. This fetching of the entitlement is referred to as validation. Since this entitlement may only be transmitted to the ticket 10 with express authorization, an encryption module 88 that encrypts the information to be transmitted and possibly provides it with an electronic signature in order to ensure the authenticity of the point where such a ticket 10 is issued, is provided in the writing/reading device. With these

security measures, it is possible for even a private user at home to issue an entitlement to an electronic ticket 10 for himself. This embodiment is preferably applied to what are known as debit-card tickets 10. With the same method, a ticket 10 can also be provided with the identity of the legitimate owner.

Apart from the USB interface 89, the construction of an inspection unit 50 corresponds to the construction of the writing/reading device 80 explained above. Both units allow a particularly simple form of link with a ticket 10 from a mechanical viewpoint: thanks to the inductive transmission to the ticket 10 and the electromagnetic transmission from the ticket 10, there is no need for an electrical coupling. It is, for example, only necessary to place the ticket 10 onto a small recess of the housing or push it into a single slot in the writing/reading device 80 or in the inspection unit 50. In the application "entitlement to be transmitted", the information unit INF1 to be transmitted may contain the corresponding command in the field COMMAND1; on the basis of this command, the further fields transmitted with the unit INF1 are correspondingly interpreted by the processor module 16 of the ticket 10. Depending on the amount of information to be transmitted, the transmission of these entitlements may also take place iteratively. With a rectifier module 97 contained on the ticket 10 in a special embodiment, the battery 19 can be charged up via the power supply module 18: the voltage generated by the inductive coupling is transformed in the rectifier module 97 into a DC voltage and fed to the power supply module 18. With the writing/reading device 80, an electronic ticket 10 - also known as an e-ticket - can be handled like a classic cardboard ticket. This writing/reading device 80 can also be used by a ticket issuing point.

A further embodiment of the present invention is explained by the block diagram of a ticket 10 according to Fig. 9, an arrangement in a motor bus 100 according to Fig. 10 and the individual method steps for registration according to Fig. 11:

- According to Fig. 9, the ticket 10 has a frame antenna 95.1, preferably with a parallel-connected resonance capacitor, which are connected via amplifiers 93.1 to 93.5 via two setpoint detectors/demodulators 94.1 and 94.2 to the processor module 16. The number of amplifiers depends on the circuit requirements and is insignificant for the present invention. The two setpoint detectors allow it to be established from which source an information unit INF1 was transmitted to the ticket 10; in addition, the meaning of the first information unit received can be established by the processor module 16 after analysis has taken place, for example of the content COMMAND1. By contrast with the embodiment according to Fig. 1, this ticket 10 has a modulator and only one transmitting module 96. Depending on the application, an encryption module 98 is also provided on the ticket 10. In the motor bus 100, 3 first transmitting units 31 are provided, each with an associated waking zone 21', and also a receiving unit 32', with an associated registration zone 22.

- The registration of tickets 10 in the motor bus 100 takes place by the method steps specified in Fig. 11: a first transmitting unit 31 sends a first information unit INF1 at a fixed or adjustable time interval t_{REP} to the tickets 10 located in the associated waking zone 21'. The tickets 10 temporarily leave the sleeping state and, in each case after a ticket-individual random time $t_{RAND'}$, $t_{RAND''}$, ..., send an information unit INF3 to the receiving unit 32'. With the randomly determined time, collisions can largely be avoided, but cannot be ruled out. However, dependable registration is

ensured by the first transmitting unit 31 continually re-waking the tickets with a periodicity T_{REP} . Within the motor bus 100, the waking cycles can be performed in a staggered manner by the various first transmitting units 31. In the first information unit INF1, the fields COMMAND1 and TYPE1 can cause the processor module 16 to instigate reversion to the sleeping state of the ticket 10 immediately after sending out an information unit INF3. This embodiment of the method according to the invention ensures that even tickets 10 with a block diagram according to Fig. 1, and according to the method steps specified by Fig. 3, are registered reliably, even in this environment with only a second receiving unit 32', i.e. without a second transmitting/receiving unit 32. The data saving of the ticket records can also be performed in the same way as with the measures disclosed according to Fig. 1 and Fig. 3. The activation of the transmitting units 31 preferably takes place after the doors have been closed and the motor bus has departed. This avoids registrations which could be caused by merely boarding and leaving a motor bus, for example by providing assistance in boarding.

The ticket 10 according to the invention can also be registered by registration machines at the entrance to a vehicle. These registration machines are of the type of the writing/reading device 80 described above. As a result, multiple use of the ticket 10 according to the invention and of the registration method is possible.

The method according to the invention can also be used for making use of comparable services and charging for them, for example as an entry ticket to a movie theater or exhibition. At an exhibition there are often various additional sections for which payment is required. The method according to the

invention allows a visitor to visit certain such sections only once without a supplementary payment.

Similarly, the invention can also be used for the monitoring and protection of persons in certain zones. This may be required in installations where there is a potential risk of accident and the last registered whereabouts of a person or of the electronic identity card assigned to that person can be established with the aid of the invention, in order that members of a rescue team can conduct a targeted search. Similarly, the invention may also be used to allow a profile of the movements of a person in a highly sensitive area with different zones to be recorded, for example including for the monitoring of a person kept in what is known as semi-captivity.

The method according to the invention also allows objects on a conveying path to be monitored; for this purpose, an electronic ticket is preferably fastened in a secured manner to the object concerned.

The invention can also be used for the generation and evaluation of statistical data, for example the occupancy of a train, without this method also resulting in charging with payment required. In particular, the invention allows statistical evaluations to be conducted virtually in real time.

Bibliography

[2] US 5,541,583

[3] US 5,418,525

[4] US 5,844,244

[5] US 5,878,124

List of abbreviations

CSMA/CD Carrier Sense Multiple Access with Collision Detection

GPS Global Positioning System

GSM Global System for Mobile Communication

LAN Local Area Network

USB Universal Serial Bus

List of designations

- 10 Electronic ticket
- 11 First receiving module
- 12 Second transmitting/receiving module
- 13 Third transmitting/receiving module
- 14 Fourth transmitting/receiving module
- 15 Antennas
- 16 Processor module
- 17 Memory module
- 18 Power supply module
- 19 Battery
- 20 Railroad carriage
- 21 Entry zone
- 21' Waking zone
- 22 Registration zone
- 23 Passenger compartment
- 24 Platform
- 25 Boarding area
- 26 Passing-through area
- 31 First transmitting unit
- 32 Second transmitting/receiving unit
- 32' Second receiving unit
- 33 Third transmitting/receiving unit
- 34 Fourth transmitting/receiving unit.
- 35 Onboard computer
- 36 Remote computer system for evaluation/billing
- 37 Connection of first transmitting unit 31 to onboard computer 35
- 38 Connection of second transmitting/receiving unit 32 to onboard computer 35
- 39 Connection of onboard computer 35 to remote computer system
- 41 First journey registration memory for fifteen short-term registrations

- 42 Second journey registration memory for fifty long-term registrations
- 43 Memory area for current first information units
- 44 Memory area for lost first information units
- 45 Program memory
- 46 Temporary memory
- 47 Debit memory for N applications
- 48 Memory area for the identity of the ticket 10
- 49 Memory area for the identity of the ticket owner
- 50 Inspection unit
- 51 Display element
- 52 Keypad
- 61 Mast
- 62 Recording box for ticket 10
- 63 Receiving unit
- 64 Marker
- 80 Writing/reading device for the validation or personification of an electronic ticket
- 81 Modulator
- 82 Demodulator
- 83 Transmitting amplifier
- 84 Receiving amplifier
- 85.1 Frame amplifier
- 85.2 Rod amplifier
- 86 Processor system
- 87 Memory module
- 88 Encryption module
- 89 USB interface with respect to the personal computer
- 91 Receiving module
- 92 Transmitting module
- 93.1 1st receiving amplifier
- 93.2 2nd receiving amplifier
- 93.3 3rd receiving amplifier
- 94.1 Setpoint detector/demodulator

94.2 Setpoint detector/demodulator

95.1 Frame antenna

95.2 Rod antenna

96 Modulator/transmitting module

97 Rectifier module

98 Encryption module

100 Motor bus

PATENT CLAIMS

1. A method for registering tickets (10) for establishing a service to be used and/or a defined presence, which tickets (10) are provided with a processor module (16), a memory module (17) and at least one first receiving module (11), and at least one transmitting/receiving unit (31, 32) for communication with tickets (10) being provided in a waking zone (21, 21') and, in a method step A, tickets (10) located in the waking zone (21, 21') receiving a first information unit (INF1) via the first receiving module (11) from a first transmitting unit (31), assigned to the waking zone (21, 21'), characterized by the method steps:

B with an item of information contained in the first information unit (INF1), a second transmitting/receiving module (12) contained on the ticket is activated, and
 C at a point in time determined by the beginning of the service to be used and/or the defined presence, a bidirectional communication between a second transmitting/receiving unit (32), assigned to registration zone (22), and the second transmitting/receiving module (12) of the tickets (10) located in the registration zone (22) is set up by means of a second and a third information unit (INF2, INF3), and the respective presence of the ticket (10) is registered at least once.

2. The method as claimed in claim 1, characterized in that the registration specified in method step C by means of the second and third information unit (INF2, INF3) includes at least information concerning the location, date/time, with this information being stored in

- an area of a memory module (17, 41, 42) on the ticket (10) and/or
- in a data bank which is assigned to

- an onboard computer (35) and/or to
- a remote computer system (36) and/or to the
- second transmitting/receiving unit (32).

3. The method as claimed in claim 1 or 2, characterized in that the further registration specified in method step C takes place only for all those tickets (10) located in the registration zone (32) which have received an identical item of information, assigned to one or more registration zones (22), concerning location and date/time (POSITION, COURSE, ADDRESS, DATETIME).

4. The method as claimed in claim 2 or 3, characterized in that the information concerning the location takes place with locational information fields (STATE3, ATTRIBUTES3, POSITION3), which are transmitted from a fixed ticket (64, 62, 10) by means of the third information unit (INF3) via a receiving unit (63) attached to a vehicle to the second transmitting/ receiving unit (32).

5. The method as claimed in one of claims 2 to 4, characterized in that, on the basis of the information concerning the location, a virtual journey section number (n, n+1) is transmitted in the second information unit (INF2) to the tickets (10) located in the registration zone (22) and is changed for each section of the journey by a counting increment; the journey section number (n, n+1) stored on the ticket (10) is compared with the current journey section number (n+1, n+2), in order to establish whether the ticket (10) was correctly registered in the previous sections of the journey.

6. The method as claimed in one of claims 1 to 5, characterized in that the second transmitting/ receiving module located on the ticket (10) is intermittently activated.

7. The method as claimed in claim 6, characterized in that the point in time of the activation of the second transmitting/receiving module (12) is established by an item of information in the first information unit (INF1) and/or by an item of information in the second information unit (INF2).

8. The method as claimed in claim 6 or 7, characterized in that the point in time of the activation of the second transmitting/receiving module (12) is determined by means of a random generator.

9. The method as claimed in one of claims 1 to 8, characterized in that the ticket (10) and/or personal information fields (TICKET_NR3, TICKET_OWNER3), identifying a person assigned to the ticket (10), are contained in the second information unit (INF2), and in method step C the reception of the third information unit (INF3) is acknowledged by transmitting a further second information unit (INF2) to the ticket (10) concerned.

10. The method as claimed in one of claims 1 to 9, characterized in that the frequency of the first transmitting unit (31) is chosen such that the field of the waking zone (21, 21') is formed as a near field.

11. The method as claimed in one of claims 1 to 10, characterized in that the frequency of the second transmitting/receiving unit (32) is chosen such that the field in the registration zone (22) is formed as a far field.

12. The method as claimed in one of claims 6 to 8, characterized in that the intermittent activation of the second transmitting/receiving module (12) is monitored by means of a timing element and, if permanently activated, the second transmitting/ receiving module (12) is switched off after a fixed time.

13. The method as claimed in one of claims 1 to 12, characterized in that, within a randomly determined time interval in each case and in a way according to method step C, tickets (10) commence bidirectional communication (INF2, INF3) with a transmitting/receiving unit (32) lying within a registration area (22), and the first registration is performed in accordance with the state of the ticket (10) and/or the pre-history of the communication (INF1).

14. The method as claimed in one of claims 1 to 13, characterized in that the tickets (10) have a third transmitting/receiving module (13), by which unidirectional or bidirectional communication is set up with a stationary third transmitting/ receiving unit (23), assigned to a passing zone, access to a zone being granted, and consequently presence registered, in accordance with data stored in a memory area (48, 49) of the memory module (17) or in a data bank of a computer system assigned to the third transmitting/receiving unit (33).

15. The method as claimed in one of claims 1 to 14, characterized in that the tickets (10) have a fourth transmitting/receiving module (14), via which bidirectional communication is set up with a fourth transmitting/receiving unit (24), provided in an issuing machine, and personal-information fields identifying a person and/or associated with

a person can be stored in an area of the memory module (17; 47, 49).

16. The method as claimed in claim 15, characterized in that registrations of the tickets (10) are identified by attributes (ATTRIBUT) in such a way that this registration merely comprises the presence, or additionally comprises use of a service requiring payment, dependent on the attributes.

17. The method as claimed in claim 15 or 16, characterized in that the attributes are established by an issuing machine via a communication with the fourth transmitting/ receiving module (14) and are displayed on an output module of the ticket (10) or in that a certain item of information is displayed on the output module of the ticket (10) on the basis of the attributes.

18. A system for registering tickets (10) for establishing a service to be used and/or a defined presence, which tickets (10) have a processor module (16), a memory module (17) and at least one first receiving module (11), and at least one transmitting/receiving unit (31, 32) for communication with tickets (10) being provided in a waking zone (21, 21') and the waking zone (21, 21') being assigned a first transmitting unit (31) for communication (INF1) via a first receiving module (11), arranged on the tickets (10), characterized in that a registration zone (22) is assigned a second transmitting/receiving unit (32), via which bidirectional communication (INF2, INF3) can be set up with tickets (10) located in the registration zone (22), the communication being able to be conducted via a second transmitting/receiving module (12), arranged on the tickets (10), in that the presence of the tickets (10) can be registered as ticket records in a memory module (16) of the tickets (10) and/or in

a data bank coupled to the second transmitting/receiving unit (32).

19. The system as claimed in claim 18, characterized in that the data bank is contained in

- an onboard computer (35) and/or in
- a remote computer system (36) and/or in
- the second transmitting/receiving unit.

20. The system as claimed in claim 18 or 19, characterized in that the first transmitting unit (31) and the second transmitting/receiving unit (32) can be connected to the onboard computer (35) via a radio link, which has the same frequency and the same transmission method as for the communication between the tickets (10) and the second transmitting/receiving unit (32).

21. The system as claimed in one of claims 18 to 20, characterized in that a third transmitting/ receiving module (13), via which communication can be set up with a third transmitting/receiving unit (33), is provided on the ticket (10).

22. The system as claimed in one of claims 18 to 21, characterized in that a fourth transmitting/ receiving module (14), via which communication can be set up with a fourth transmitting/receiving unit (34), located in an issuing machine, is provided on the ticket (10).

23. The system as claimed in claim 22, characterized in that the issuing machine is designed as a portable inspection unit (50), into which at least one ticket (10) can be inserted, in that the ticket records located on the ticket (10) can be displayed on a display element (51) of the inspection unit

(50) and in that communication (INF1, INF2, INF3) can be set up from the first and second transmitting/receiving unit (31, 32) to the inspection unit (50).

24. The system as claimed in one of claims 18 to 23, characterized in that a fixed ticket (64, 62, 10) for the transmission of locational information concerning the respective location with information fields (STATE3, ATTRIBUTES3, POSITION3) to a receiving unit (63) assigned to at least one registration zone is provided and in that the receiving unit (63) is coupled to the first and/or second transmitting/receiving unit (31, 32) for supplying the locational information.

25. A method for registering tickets (10) for establishing a service to be used and/or a defined presence, which tickets (10) are provided with a processor module (16), a memory module (17) and at least one first receiving module (11), and at least one transmitting/receiving unit (31, 32') for communication with tickets (10) being provided in a registration zone (21, 21', 22) and, in a method step A, tickets (10) located in the registration zone (21, 21', 22) receiving a first information unit (INF1) via the first receiving module (11) from the transmitting unit (31), characterized by the method steps:

B with an item of information contained in the first information unit (INF1), a transmitting module (12) contained on the ticket is activated, in order to transmit a further information unit (INF3) to the second receiving unit (32') assigned to the registration zone (22),

C with the reception of the further information unit (INF3), the respective presence of the tickets (10) is registered at least once as a ticket record.

26. The method as claimed in claim 25, characterized in that the registration specified in method step C by means of the first and further information unit (INF1, INF3) includes at least information concerning the location and date/time, with this information being stored in

- an area of a memory module (17, 41, 42) on the ticket (10) and/or
- in a data bank which is assigned to
- an onboard computer (35) and/or to
- a remote computer system (36) and/or to the
- second receiving unit (32').

27. The method as claimed in claim 25 or 26, characterized in that, on the basis of the information concerning the location, a virtual journey section number (n, n+1) is transmitted in the first information unit (INF1) to the tickets (10) located in the registration zone (22) and is changed for each section of the journey by a counting increment; the journey section number (n, n+1) stored on the ticket (10) is compared with the current journey section number (n+1, n+2), in order to establish whether the ticket (10) was correctly registered in the previous sections of the journey.

28. The method as claimed in one of claims 25 to 27, characterized in that the point in time of the activation of the transmitting module (12) is determined by means of a random generator.

29. The method as claimed in one of claims 25 to 28, characterized in that the frequency of the first transmitting unit (31) is chosen such that the field in the registration zone (21, 21', 22) is formed as a near field.

30. The method as claimed in one of claims 25 to 29, characterized in that the frequency of the transmitting module

(12) is chosen such that the field in the registration zone (21, 21', 22) is formed as a far field.

31. The method as claimed in one of claims 10, 11 or 25 to 30, characterized in that the first information unit (INF1) can be transmitted from a writing/ reading device (80) to the ticket (10), the first information unit (INF1) comprising in particular an entitlement to the use of a service or an identification, and it being possible for bidirectional communication between the writing/ reading device (80) and the ticket (10) to be set up with the third or further information unit (INF3) by means of method step B.

32. The method as claimed in claim 31, characterized in that the writing/reading device (80) is coupled to a network (89) and the transmission of an entitlement, contained in the first information unit (INF1), to the ticket (10) is only enabled if this entitlement has been validated beforehand via the network.

33. The method as claimed in claim 32, characterized in that the ticket (10) can be pushed into the writing/reading device (80) or can be placed onto the writing/reading device (80) and the transmission of the first information unit (INF1) to the ticket (10) takes place by an inductive coupling and the transmission of the third or further information unit (INF3) to the writing/ reading device (80) takes place by an electromagnetic coupling.

34. A system for registering tickets (10) for establishing a service to be used and/or a defined presence, which tickets (10) have a processor module (16), a memory module (17) and a first receiving module (11), and at least one transmitting/receiving unit (31, 32') for communication with

tickets (10) being provided in a registration zone (21, 21', 22), and the registration zone (21, 21', 22) being assigned a receiving unit (32') and at least one first transmitting unit (31) for communication via a respective receiving module (11) and transmitting module (12), arranged on the tickets (10), characterized in that it is possible by means of a first information unit (INF1), which can be transmitted to the ticket, and a further information unit (INF3), which can be transmitted from the ticket (10) to the receiving unit (32), for the presence of the tickets (10) located in the registration zone (21, 21', 22) to be registered as ticket records in a memory module (16) of the tickets (10) and/or in a data bank coupled to the receiving unit (32').

35. The system as claimed in claim 34, characterized in that the frequency of the first transmitting unit (31) is chosen such that the field in the registration zone (21, 21', 22) is formed as a near field.

36. The system as claimed in claim 34 or 35, characterized in that the frequency of the transmitting module (12) is chosen such that the field in the registration zone (21, 21', 22) is formed as a far field.

37. The system as claimed in one of claims 18 to 24 or 34 to 36, characterized in that, for at least one first information unit (INF1) which is to be transmitted to a ticket (10) and comprises in particular an entitlement to the use of a service or an identification, a writing/reading device (80) is provided, including the following:

- means for recording a ticket (10),
- a processor system (86, 87)
- a receiver comprising an antenna (85.1) and a receiving amplifier (83) for the inductive coupling to the ticket (10);

Amended Sheet

- a transmitter comprising an antenna (85.2) and a transmitting amplifier for the electromagnetic coupling to the ticket (10).

38. The use of the method as claimed in one of patent claims 1 to 17 or 25 to 33 for means of transport, exhibitions and protected zones.

Fatherstonhaugh & Co.
Ottawa, Canada
Patent Agents

/kf

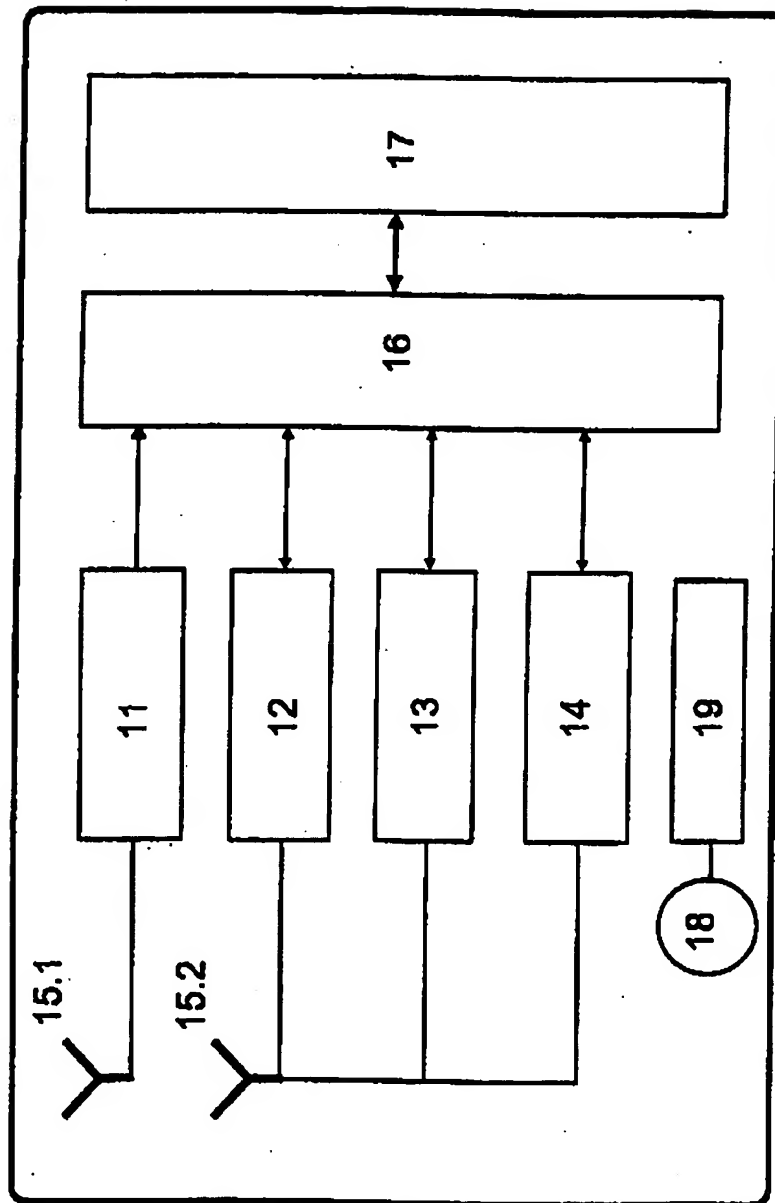


Fig. 1

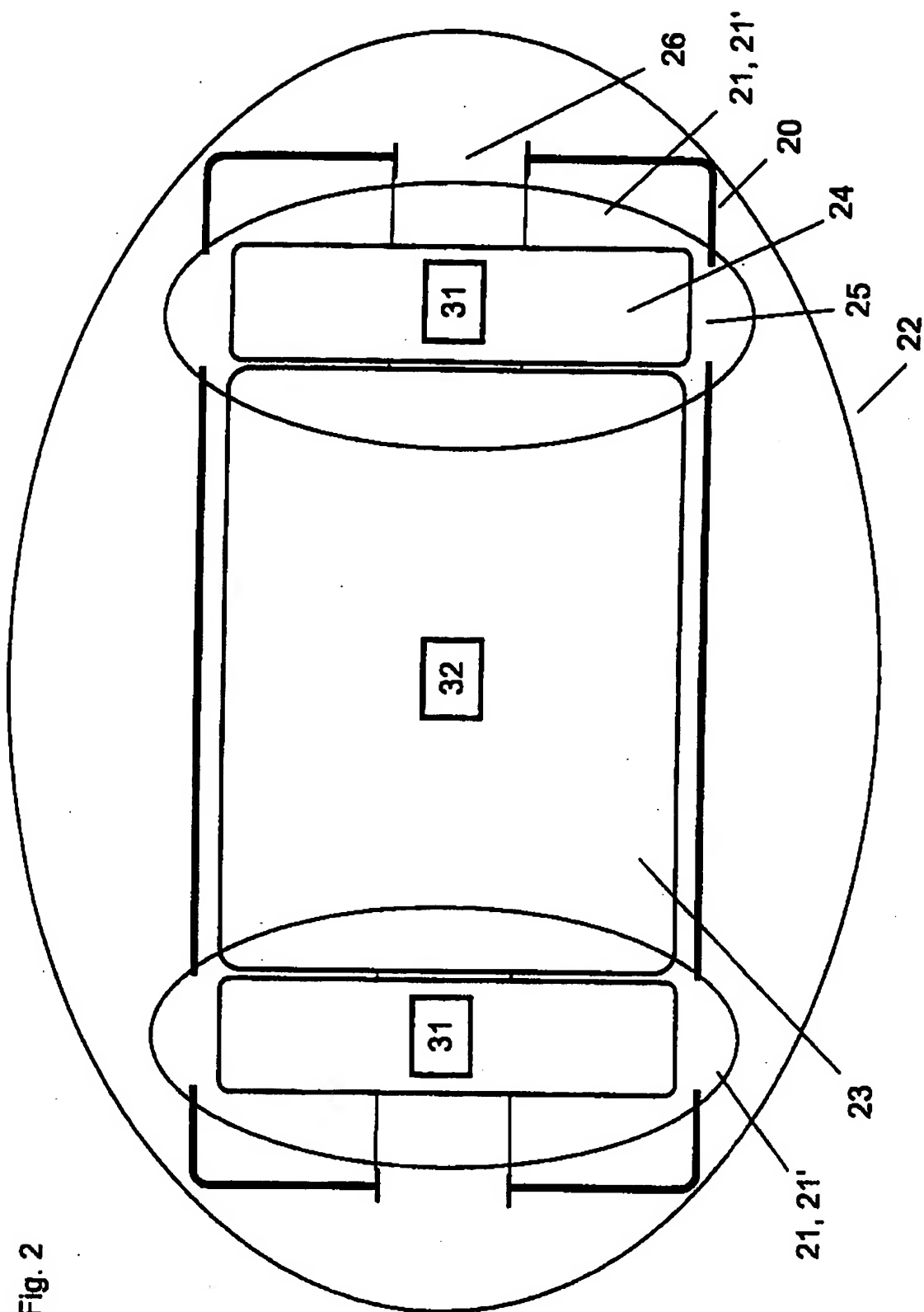
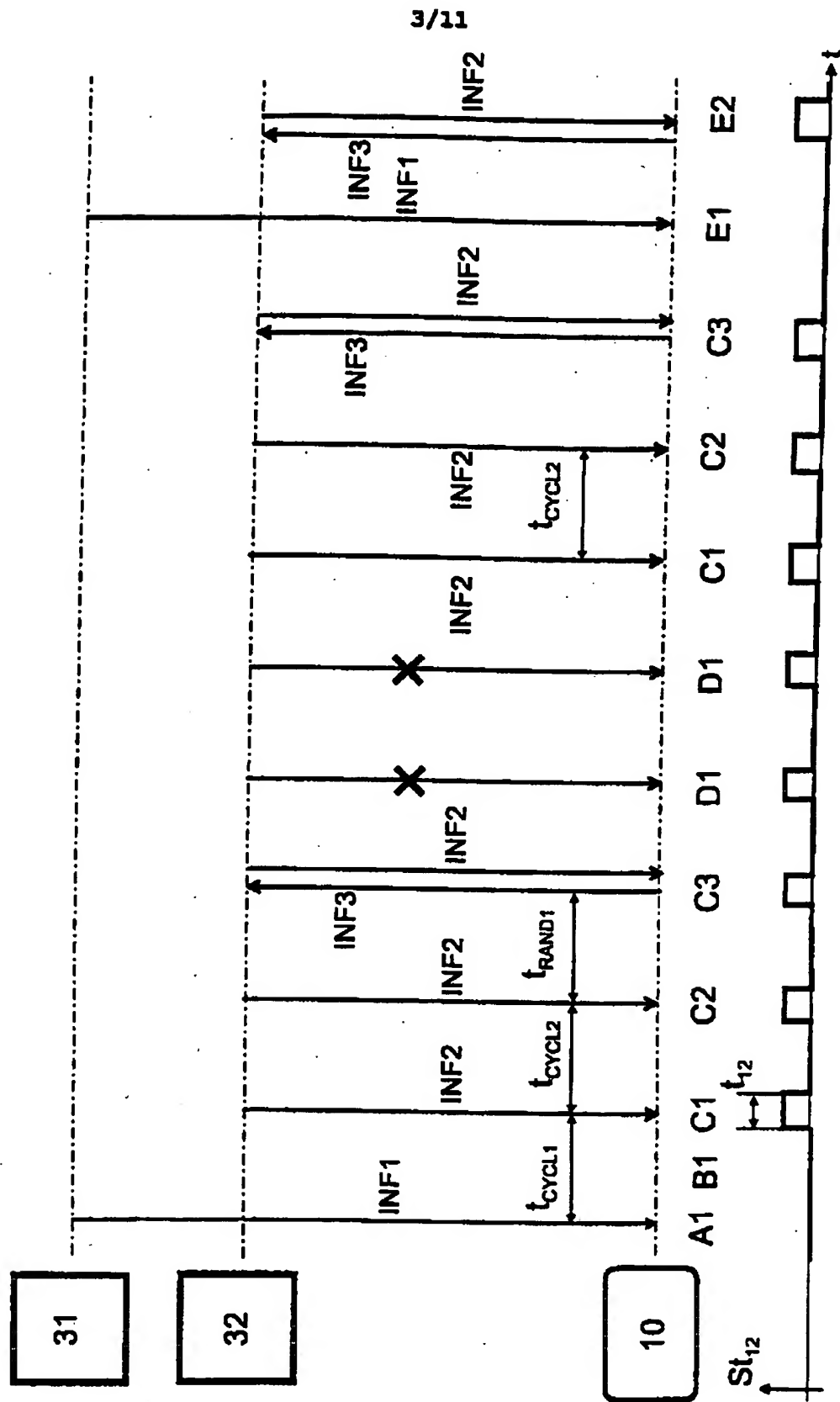


Fig. 2

Fig. 3

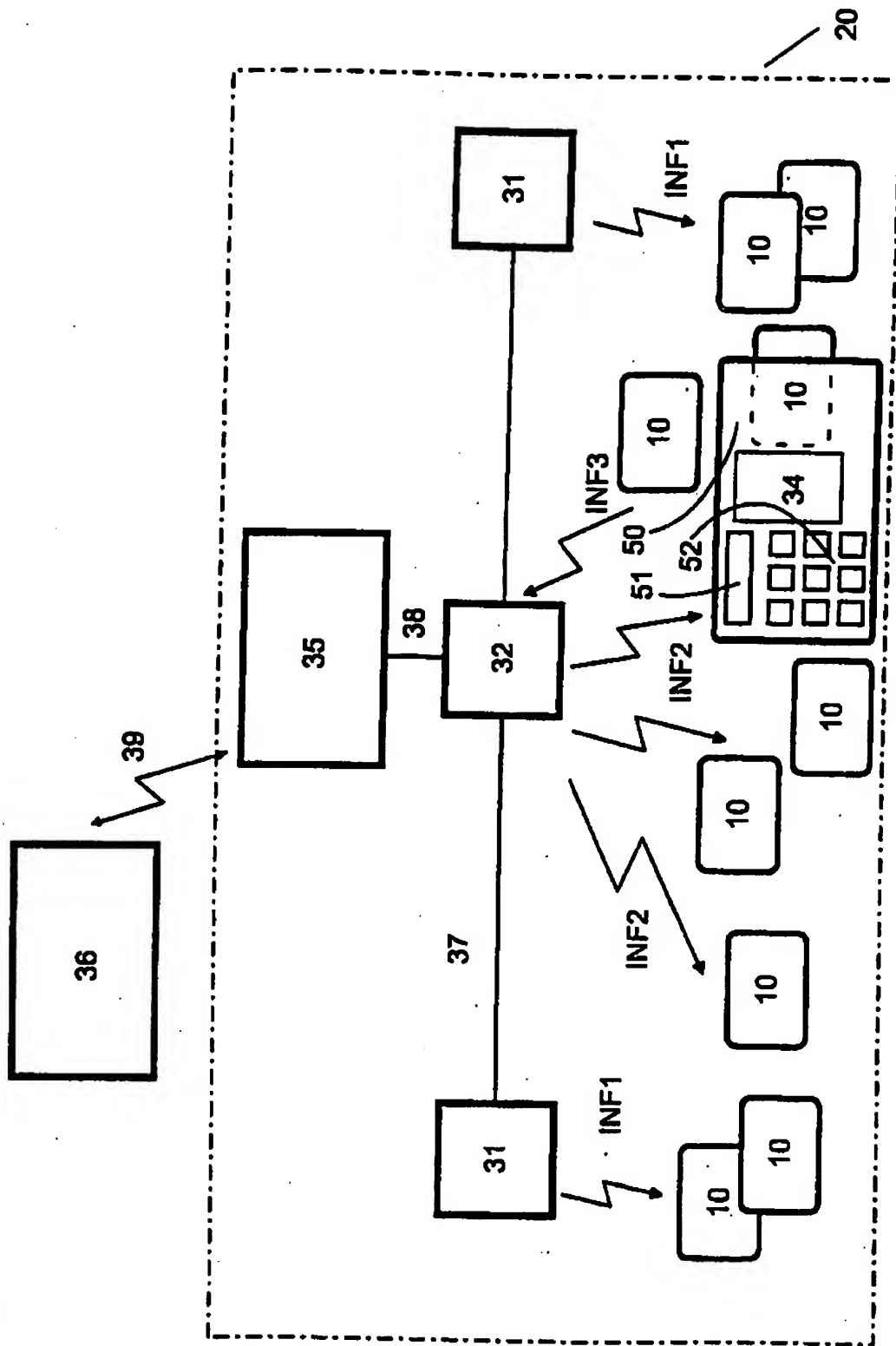


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Fig. 4

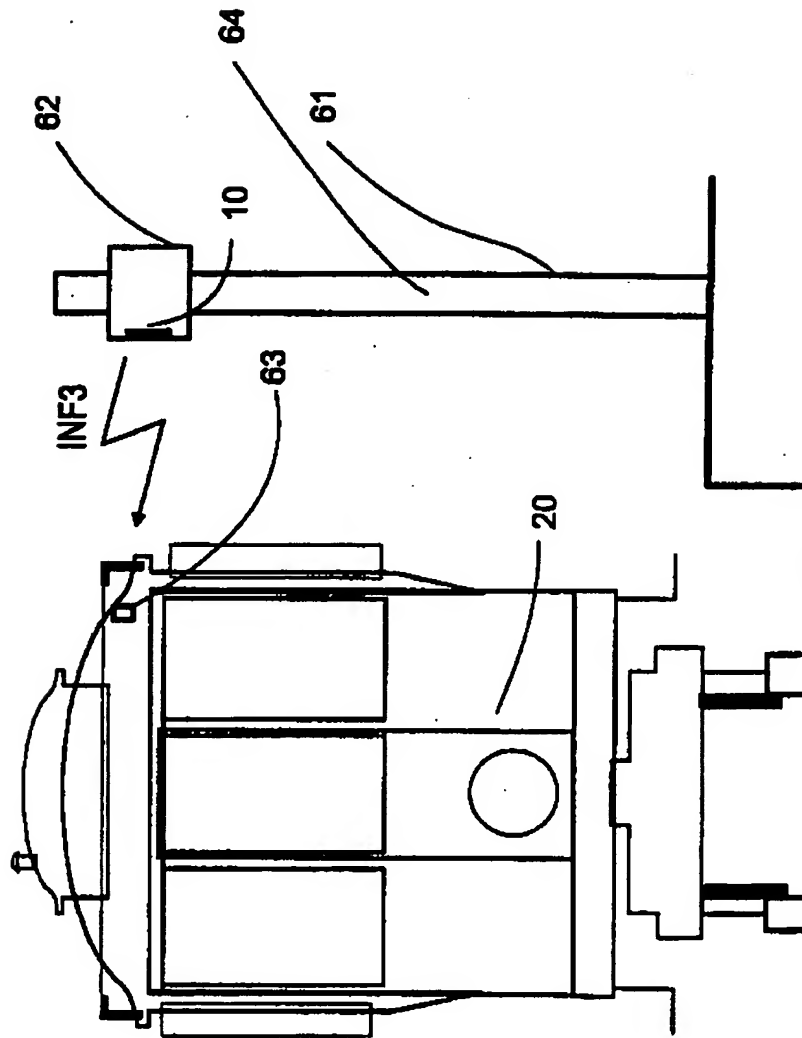
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41	
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D ₁	47
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D _N	
48	
49	

Fig. 5



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Fig. 6



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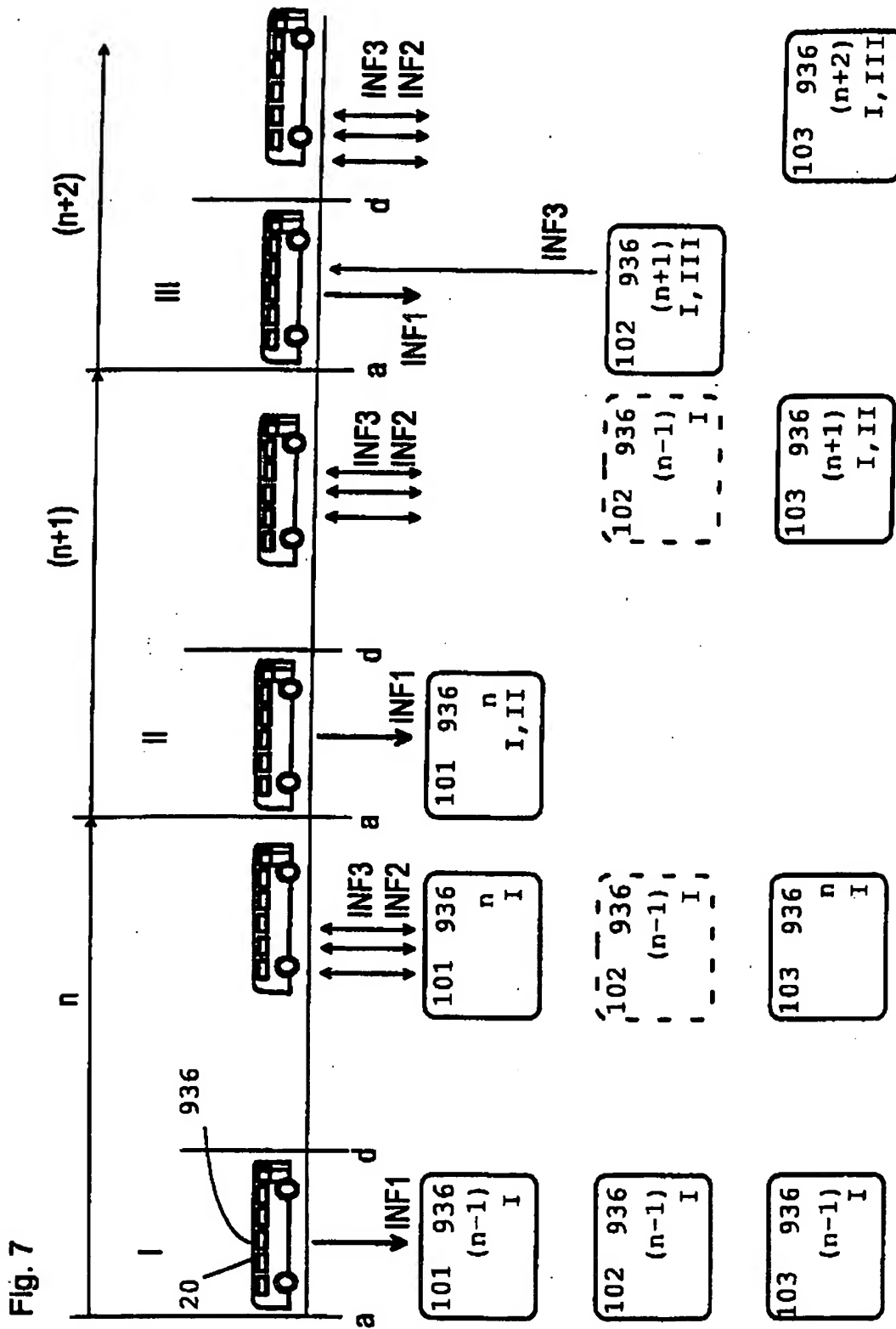


Fig. 8

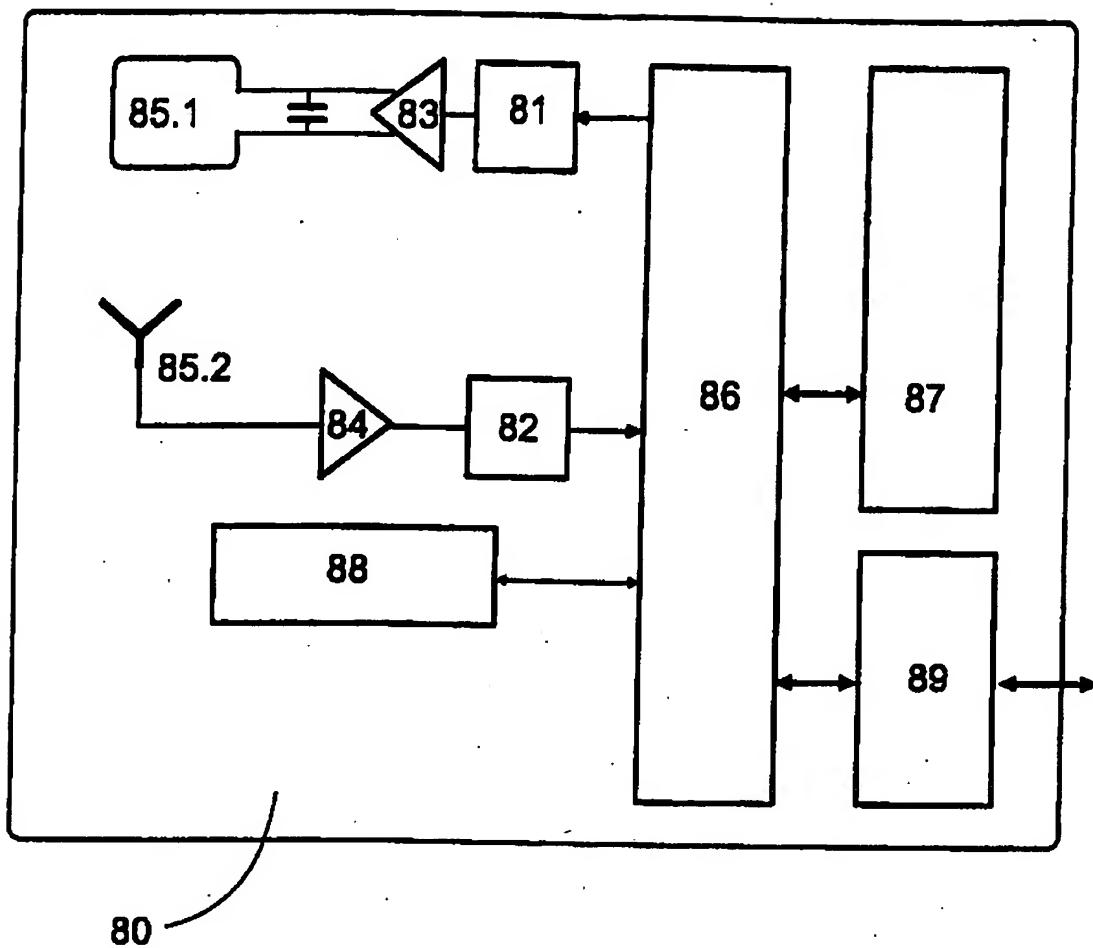
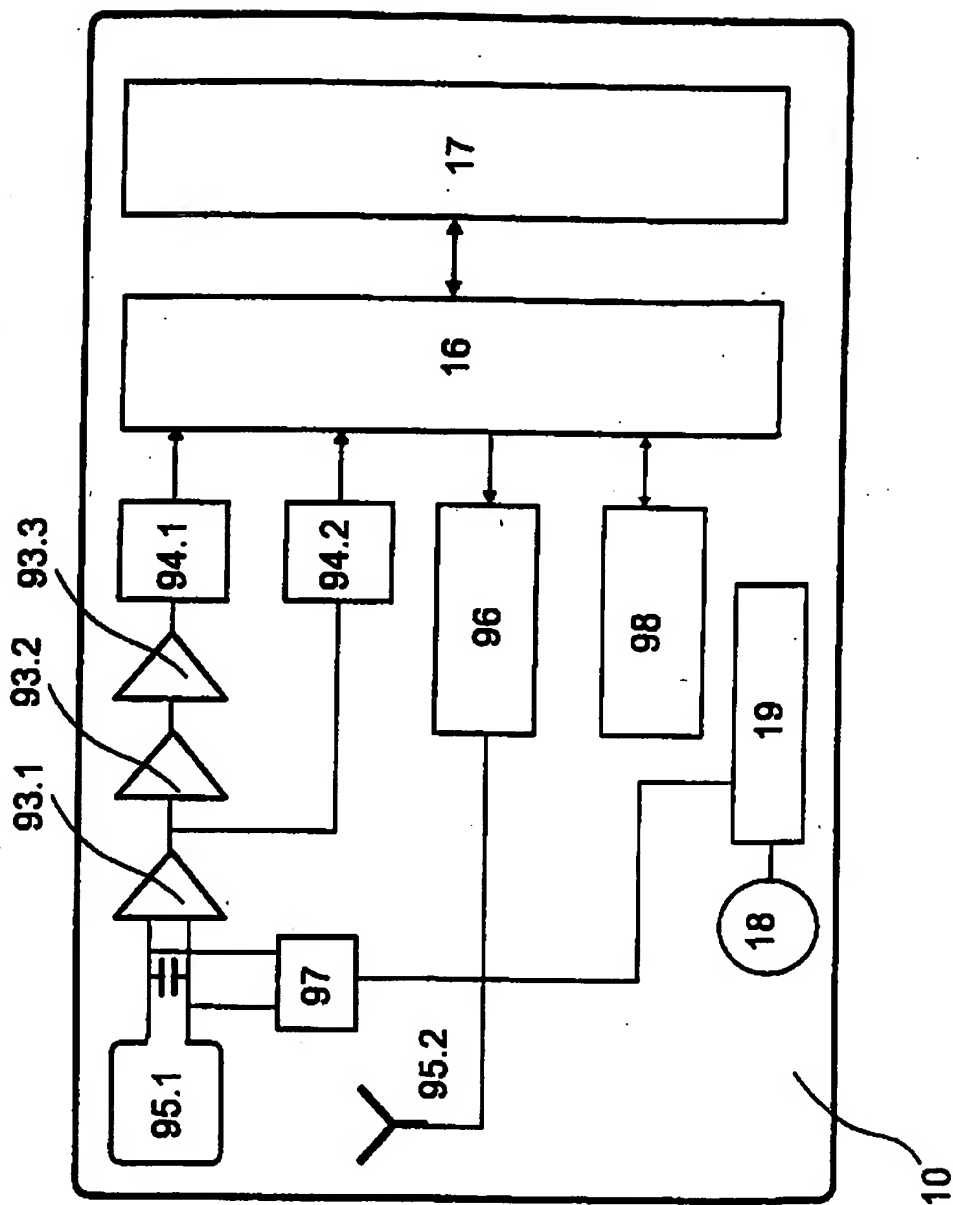
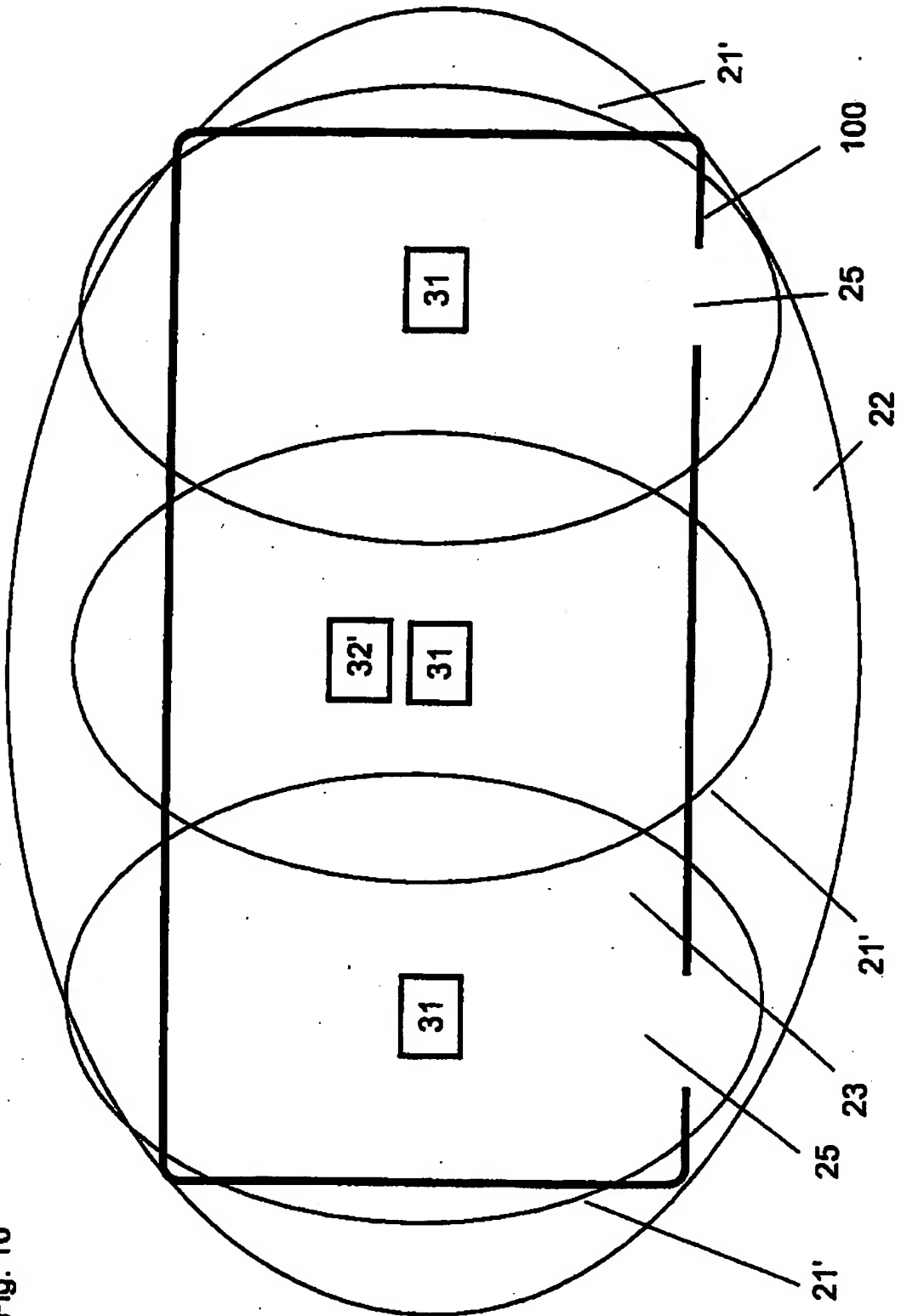


Fig. 8

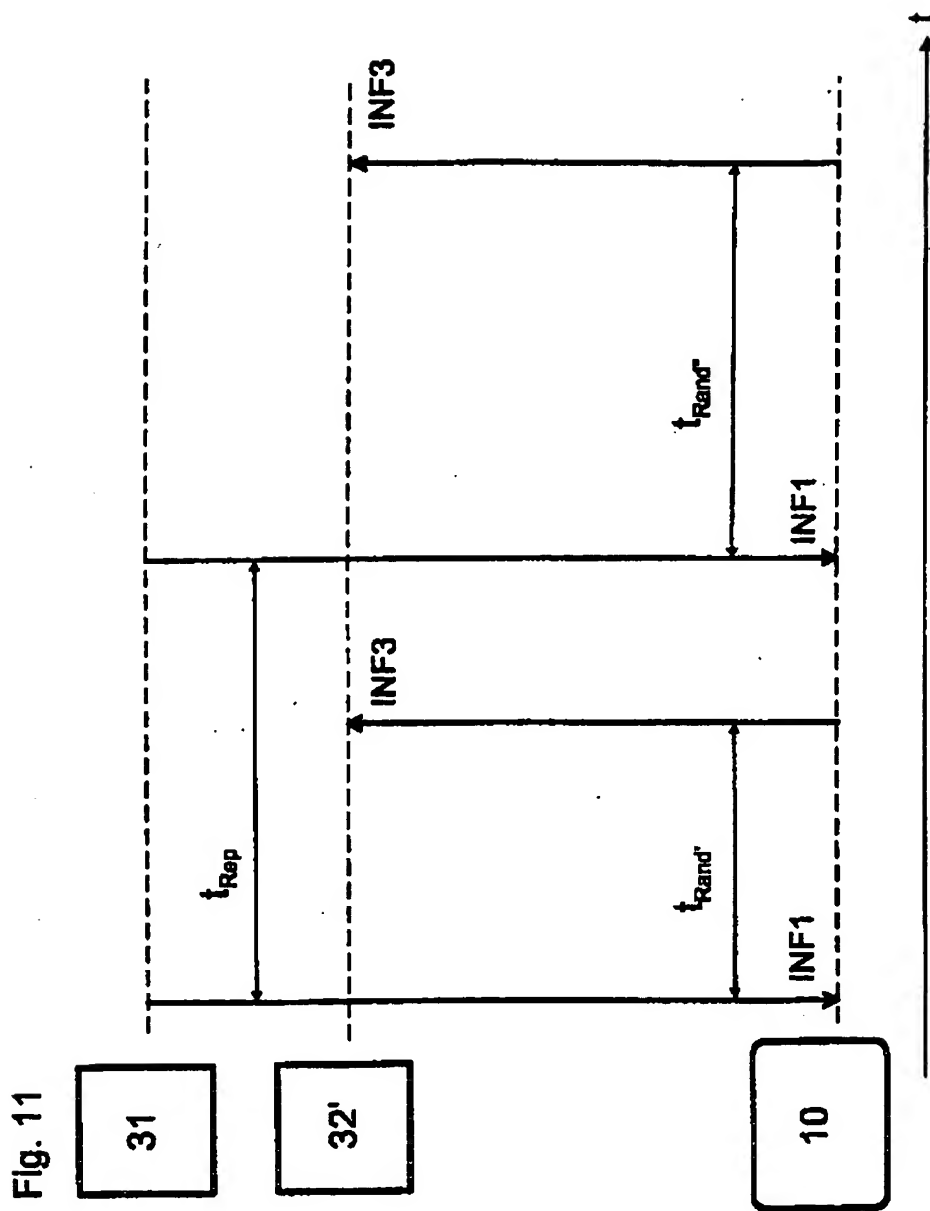


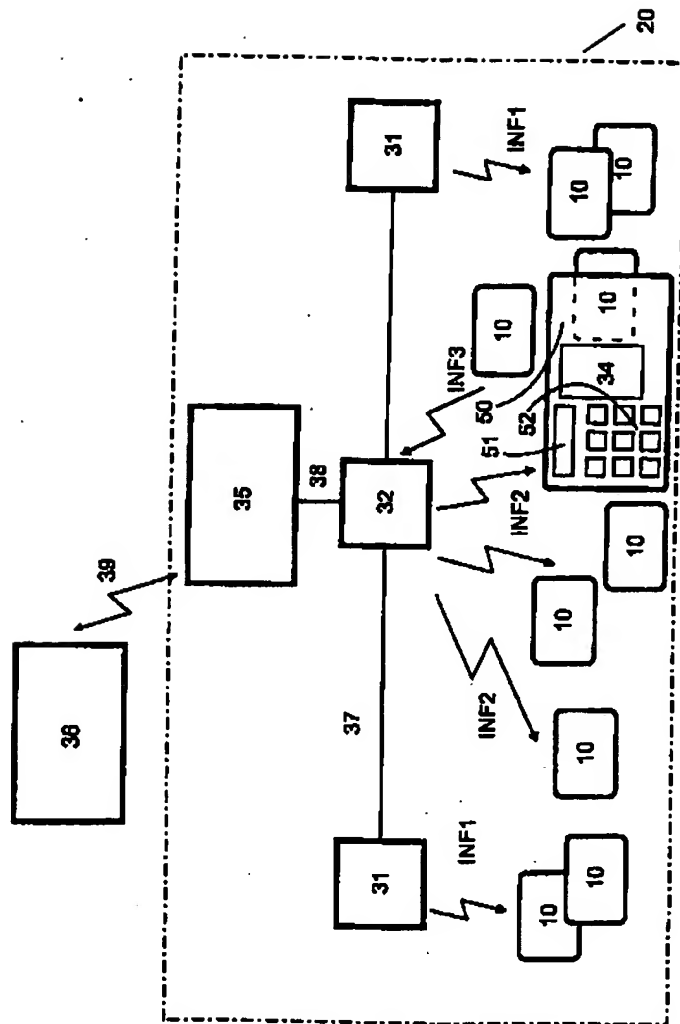
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Fig. 10



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